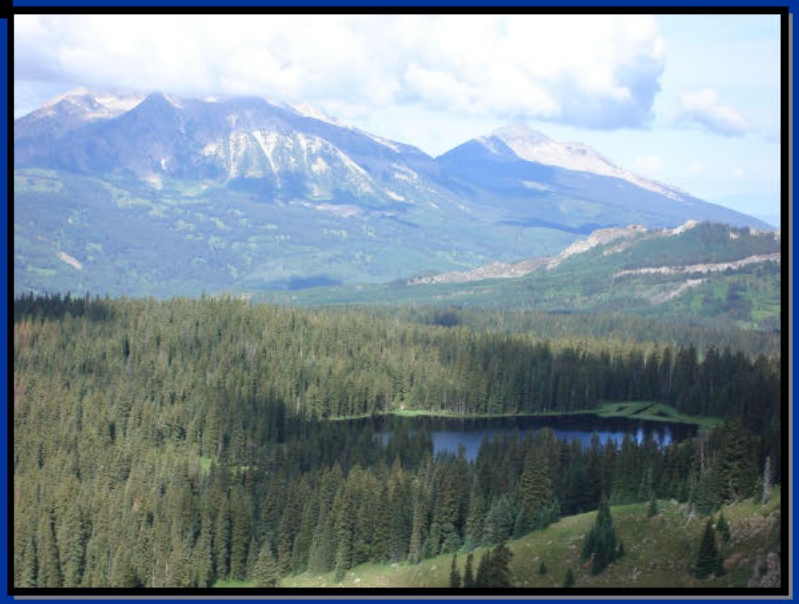
Source Control (Phase 1) Remedy

Standard Mine Site

- Historic mining area – lead, zinc, copper, silver
- EPA-lead site with U.S. Forest Service and State of Colorado
- Located at 11,000 feet; 3 month construction season; Limited winter access
- Listed on NPL - August 2005; ROD signed September 2011
- One OU – Two phased remedy, if needed



Risks

- Human Health Risks
  - Elk Creek flows to Coal Creek, sole source drinking water supply for the Town of Crested Butte
  - Potential blowout of water behind Level 1 blockage
  - No exceedance of MCLs
  - Human health risks from site soils were addressed during 2006 – 2008 Removal Actions
- Ecological Risks
  - Current Elk Creek water quality does not support macroinvertebrates and trout

Water Quality

Adit Discharge		Elk Creek	
Cadmium:	80 to 150 µg/L	Cadmium:	0.2 to 43 µg/L
Copper:	105 to 870 µg/L	Copper:	1.1 to 47 µg/L
Lead:	130 to 1500 µg/L	Lead:	1.8 to 66 µg/L
Manganese:	4000 to 12,000 g/L	Manganese:	1 to 3000 µg/L
Zinc:	13,000 to 27,000 µg/L	Zinc:	40 to 8,200 µg/L

- Elk Creek regularly exceeds Colorado Water Quality Standards for cadmium, lead, and zinc
- Remedy will address risks to water supply and aquatic life
- Waste rock stabilization and water management at Levels 5 and 98 will further reduce risks to water supply and fish

Remedial Action Objectives (RAOs)

Surface Water RAOs

- Reduce in-stream metal concentrations and sediment loading to the extent practicable in Elk Creek to lessen water quality impacts and maximize reasonably attainable water uses in Elk Creek.
- Reduce water flow through mine workings and contaminated soils to reduce metal loading to Elk Creek.

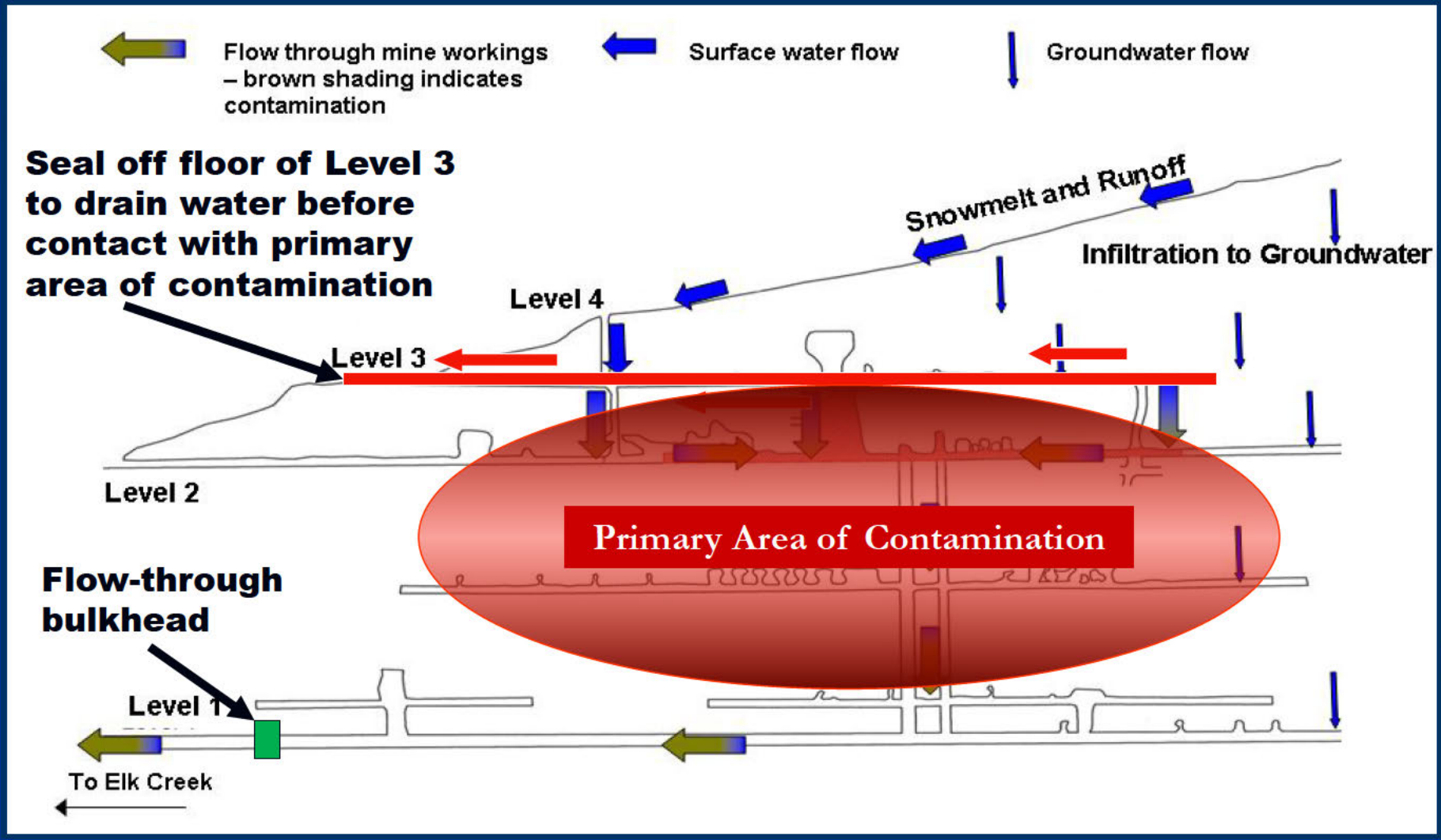
Soil and Waste Rock/Tailings RAOs

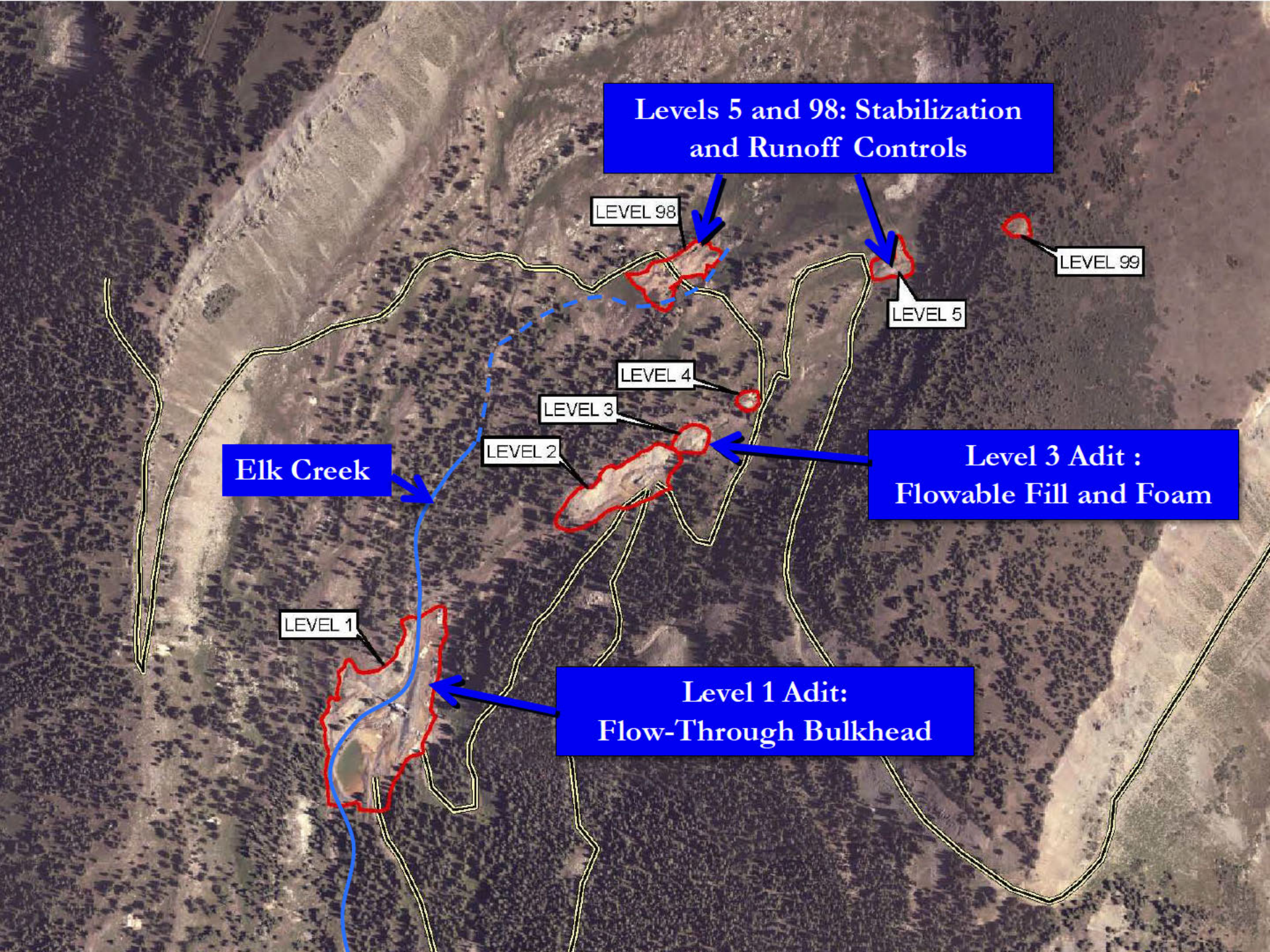
- Control and/or reduce run-on and runoff from tailings/waste rock piles to minimize generation of contaminated runoff and groundwater and to reduce sediment loading of streams.
- Reduce human exposure to dust and ecological impacts from impacted soils and waste rock by maintaining the vegetative cover over treated soils and waste rock.

Two Phased Remedy

- Source Controls (Phase 1):
  - **Rehabilitate Level 1 and Level 3 adits (Phase 1 Segment 1 - addressed in this funding request)**
  - Bulkhead in Level 1
  - Seal floor of Level 3 to reduce flow to primary area of contamination
  - Level 5 and Level 98 adit discharge channels and waste rock stabilization
  - Environmental covenants
- Interim Monitoring
- Water Treatment (Phase 2), if needed: Treat AMD
  - Passive bioreactor to treat AMD at Level 1
    - Addressed in future RA funding request

Proposed Cleanup Strategies Inside Mine Workings




Levels 5 and 98: Stabilization and Runoff Controls
LEVEL 98
LEVEL 99
LEVEL 5
LEVEL 4
LEVEL 3
LEVEL 2
Elk Creek
Level 3 Adit : Flowable Fill and Foam
LEVEL 1
Level 1 Adit: Flow-Through Bulkhead

Remedial Action Costs

Remedial Action	Cost	State Share	EPA Share	Schedule
Phase 1 Segment 1	**$2,020,000 - $2,730,000**	**$202,000 - $273,000**	**$1,818,000 - $2,457,000**	**Start August 2013, Complete FY2014/4**
Phase 1 Segment 2	$2,300,000	$230,000	$2,070,000	FY 2015/4
Phase 1 Total	$$,320,000 - $5,030,000	$432,000 - $503,000	$3,888,000 - $4,527,000	FY 2015/4
Phase 2 (**if needed**)	$ 1,440,000	$144,000	$1,296,000	
Total	$5,760,000 - $6,470,000	$576,000 - $647,000	$5,184,000 – 5,823,000	

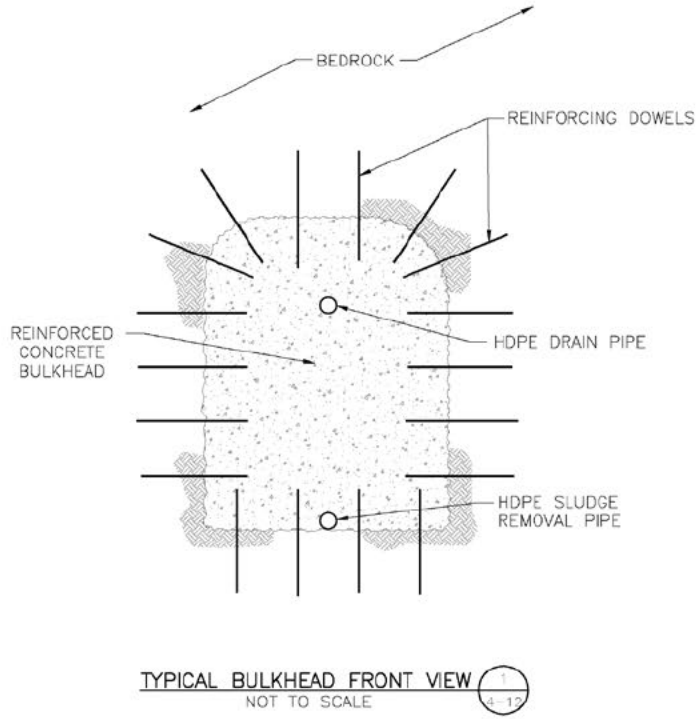
Bulkhead in Level 1 to reduce blowout potential and control water releases

Level 1 adit portal

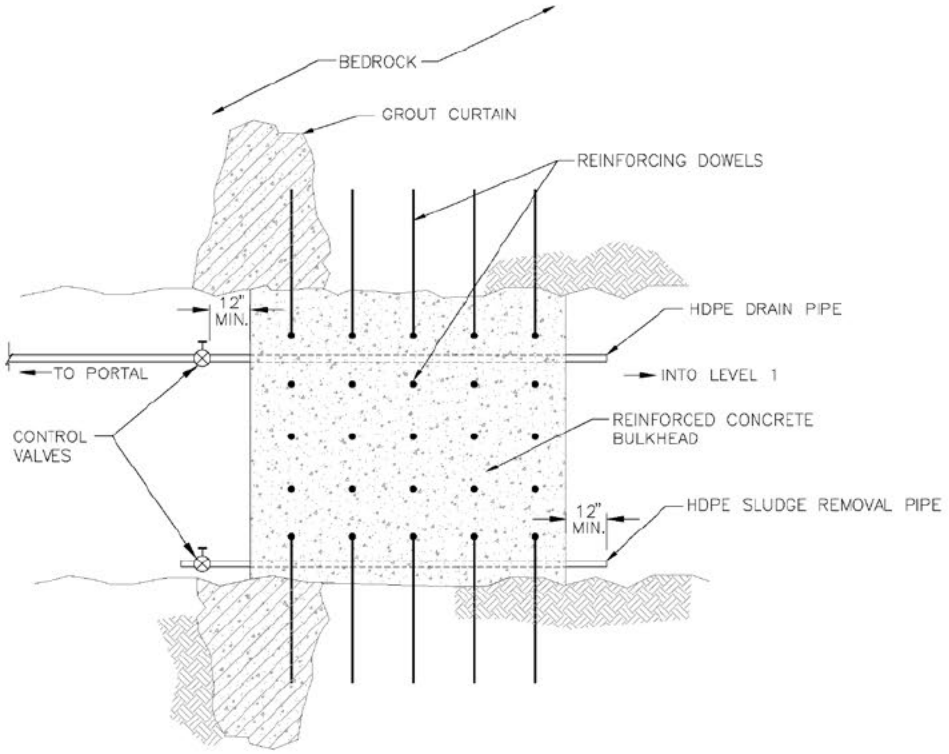
Bulkhead in Level 1

- Rehabilitate adit to allow construction
- Concrete flow-through bulkhead
  - Valve to regulate discharge
- Pipes for discharge and cleanout
- Controlled water discharge from Level 1
- Used to control flow to Phase 2 water treatment system, if needed

Bulkhead at Level 1



TYPICAL BULKHEAD FRONT VIEW (1, 4-12)
NOT TO SCALE



TYPICAL BULKHEAD FRONT VIEW (2, 4-12)
NOT TO SCALE

NOTES:

1. BULKHEAD CONSTRUCTED WITH A MINIMUM OF 150 FEET OF BEDROCK COVER.
2. HDPE DRAIN PIPE EXTENDS OUTSIDE OF THE PORTAL (NOT SHOWN). A CONTROL VALVE TO BE INSTALLED INSIDE OF THE PORTAL FOR RELEASE OF RETAINED DRAINAGE.

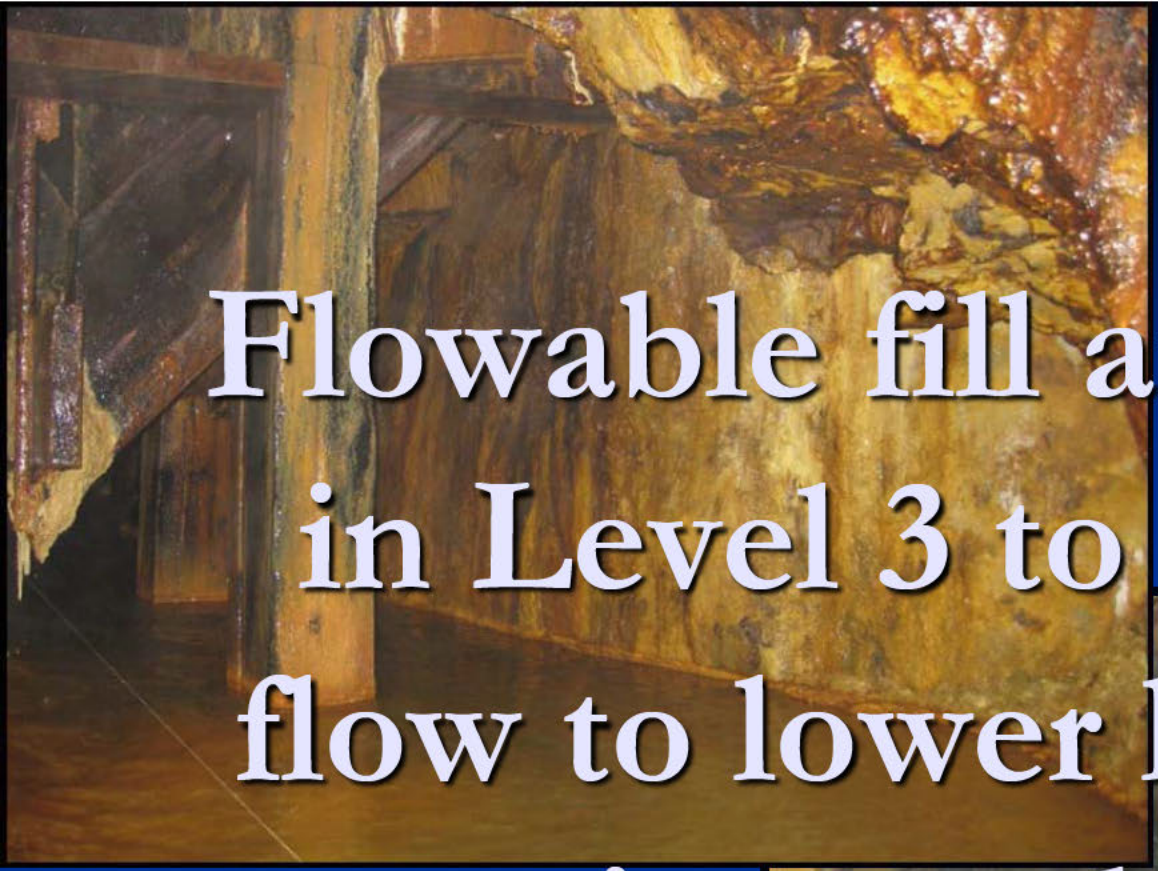
NOT FOR CONSTRUCTION

URS OPERATING SERVICES

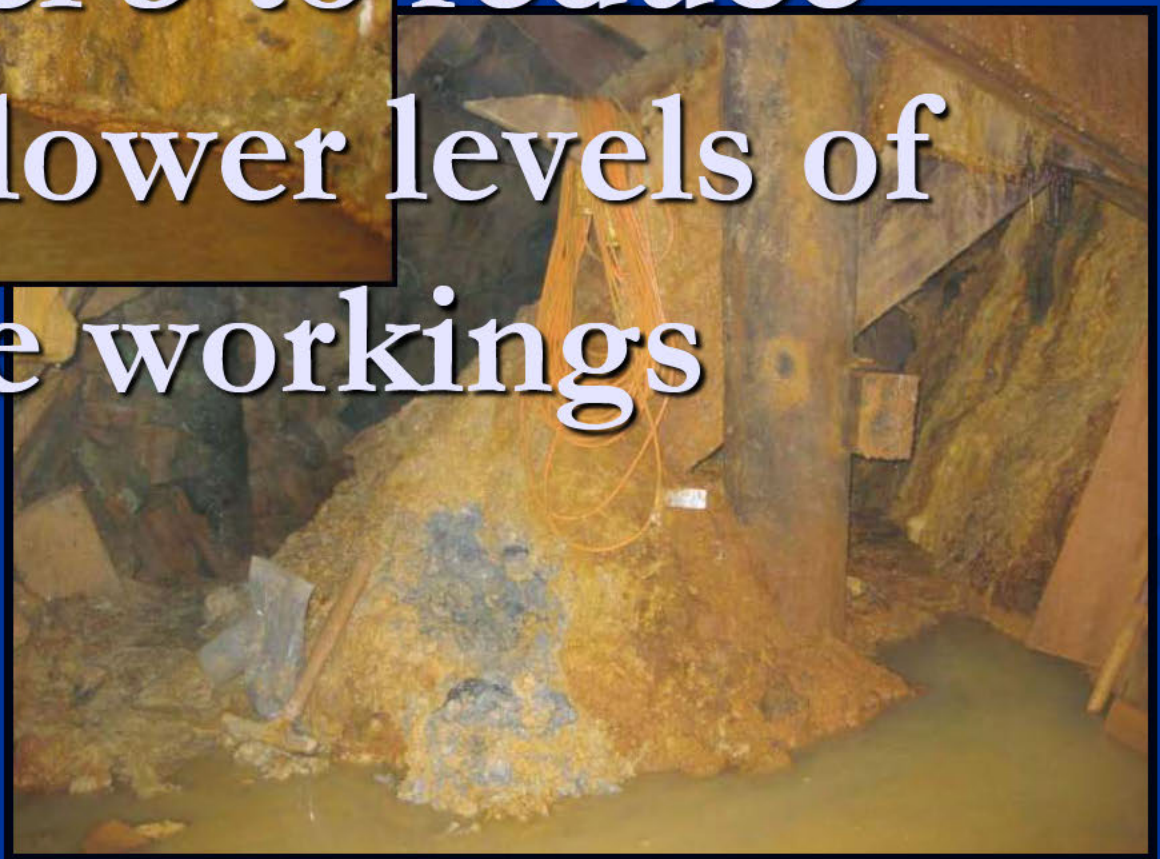
STANDARD MINE
GUNNISON COUNTY, CO
Alternative 5
Bulkhead in Level 1
Figure 4-12

December 2009 TDD No. 0608-07

URS DATE: 12/10/2009 RAM FILENAME: N:\Projects\22241112_Standard_Mine_RI_FS\Sub_00\7.0_CAD_GIS\Analysis of Alternatives\Alternative 5\Alternative 5.dwg



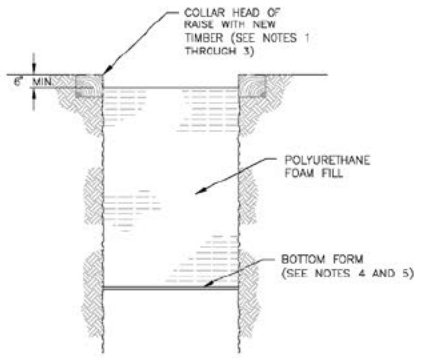
Flowable fill and foam in Level 3 to reduce flow to lower levels of mine workings



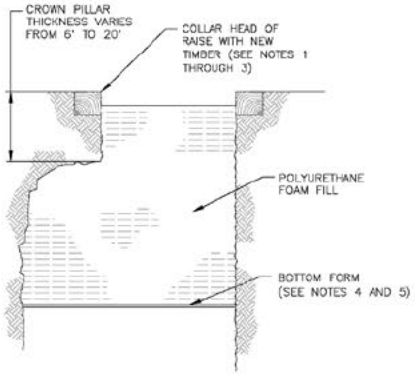
Flowable Fill and Foam – Level 3

- Rehabilitate Level 3 adit
- Seal raises to lower mine workings with foam
- Fill fractures and mineralized zones on ribs and floor
- Seal floor with flowable fill
- Level 3 water directed to exit at portal
- Convey discharge to Elk Creek at Level 1

Flowable Fill in Level 3



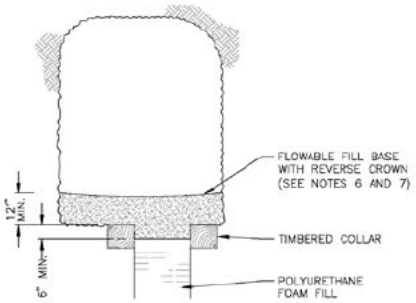
POLYURETHANE FOAM RAISE CLOSURE DETAIL 1 4-14
NOT TO SCALE



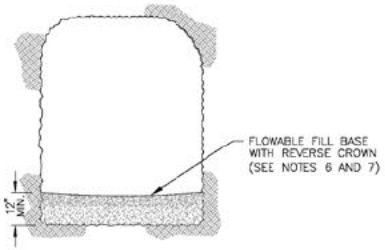
POLYURETHANE FOAM RAISE CLOSURE WITH THIN CROWN PILLAR DETAIL 2 4-14
NOT TO SCALE

NOTES:

1. REMOVE ROCK AT HEAD OF RAISE UNTIL TIMBER CAN BE SET ON COMPETENT ROCK.
2. SET TIMBER COLLAR FLUSH WITH FLOOR.
3. LEAVE 6-INCH MINIMUM GAP BETWEEN TOP OF FOAM AND TOP OF TIMBER COLLAR.
4. BOTTOM FORM TO BE PLYWOOD OR OTHER SUITABLE MATERIAL STRONG ENOUGH TO SUPPORT WEIGHT OF FOAM.
5. GAPS BETWEEN BOTTOM FORM AND RAISE WALLS TO BE PLUGGED WITH PLASTIC TARP, CARPET, SMALL FOAM BLOCKS, ETC. TO MINIMIZE LEAKAGE OF FOAM BETWEEN GAPS BEFORE FOAM SETS.
6. FLOOR TO BE CLEARED OF DEBRIS, PIPE, RAIL, LOOSE TIMBER, ETC. BEFORE PLACING FLOWABLE FILL.
7. FLOWABLE FILL TO BE PLACED WITH MIN. DEPTH OF 12 INCHES FROM FACE TO PORTAL MAINTAINING POSITIVE DRAINAGE AND INCORPORATING A REVERSE CROWN TO FACILITATE DRAINAGE.



FLOWABLE FILL RAISE OPENING DETAIL 3 4-14
NOT TO SCALE



FLOWABLE FILL RAISE OPENING WITH THIN CROWN PILLAR DETAIL 4 4-14
NOT TO SCALE

NOT FOR CONSTRUCTION

URS OPERATING SERVICES

STANDARD MINE
GUNNISON COUNTY, CO
Alternative 7
Flowable Fill and Foam in Level 3
Figure 4-14

December 2009 TDD No. 0608-07

Mine Waste Stabilization and Adit Discharge Controls at Levels 5 and 98

- Vegetative or rock cap of mine waste
- Convey adi discharge around mine spoils

Highly Concerned Community

- Highly Concerned Community
  - Standard Mine Advisory Group (SMAG)
  - Technical Advisory Group (TAG)
  - Coal Creek Watershed Coalition
  - Town of Crested Butte
- Project Completion
  - Likely that Phase 1 will meet project and community goals and objectives
  - State of Colorado supports segmenting Phase 1 work to allow for thorough design of components